

## Section 906. STRUCTURAL STEEL

**906.01 General Requirements.** Finished rolled shapes shall be free from cracks, flaws, injurious seams, laps, blisters, rust pits, ragged and imperfect edges and other imperfections affecting strength and durability. Rolled shapes shall have a smooth, uniform finish and shall be straightened, if necessary, in the mill before shipment.

Rolled shapes shall be furnished according to the general requirements for delivery of structural steel, ASTM A 6.

Source of supply shall be according to subsection 105.01.

**906.02 Testing.** Testing will be as provided in ASTM A 6 and AASHTO T 244 for mechanical testing of steel products, and in the ASTM and AASHTO specification for the material referred to herein.

**906.03 Mill Inspection.** Mill inspection will be waived unless required in the proposal or subsequently deemed necessary by the Engineer. When required, mill inspection in conformance with the provisions of Division 1 and subsections 906.01 and 707.02 will be provided. Ample notice of the beginning of rolling shall be given to the Department so that inspection may be provided. Mill test reports according to subsection 707.02 are required.

**906.04 Structural Steel.** Steel used in highway structures shall be as specified on the plans or in the proposal and shall conform to the requirements specified herein.

Where impact tests are required, the producer shall make and report the impact tests for heat qualification according to the sampling and testing procedures of AASHTO T 243. The (H) frequency of heat testing shall be used, unless otherwise specified.

The governing thickness for beams, tees, and channels shall be the average flange thickness. The governing thickness for angles shall be the specified leg thickness. Test specimens for these sections shall be taken at a point one-third the distance from the outer edge of the flange or leg to the web or heel of the section.

The Department may reject any structural steel covered by these requirements which by subsequent impact testing, conducted at the option of the Department, fails to produce the required impact strength.

- A. **AASHTO M 270 Grade 36 Structural Steel.** All primary member material including, but not limited to, rolled beams, cover plates, flange plates, web plates, link bars, end diaphragms and connection plates, intermediate crossframes and connection plates of horizontally curved girders shall meet the longitudinal Charpy V-Notch impact test requirement of 15 ft-lb at a test temperature of 40 °F. When designated on the plans, the testing temperature for critical load carrying members shall be lowered 30 °F.

- B. **High-Strength Structural Steel.** High-strength structural steel shall meet the requirements specified in AASHTO M 270 for Grade 50 or shall meet the requirements for Types A, B, or C of AASHTO M 270 Grade 50W.

All primary member material including, but not limited to, rolled beams, cover plates, flange plates, web plates, link bars, end diaphragms and connection plates, intermediate crossframes and connection plates of horizontally curved girders and center beams and support bars of modular bridge expansion joints shall meet the longitudinal Charpy V-Notch impact requirements as follows:

Steel with a yield point of (65 ksi, 65 - 75 ksi, 75 - 85 ksi, or over 85 ksi) at the testing temperature of (40 °F, 25 °F, 10 °F, -5 °F), respectively, shall achieve longitudinal Charpy V-Notch impact values of:

1. 15 ft-lb for steel 2 inches thick and all mechanically fastened steel, or
2. 20 ft-lb for steel thicker than 2 inches.

When designated on the plans, the testing temperature for critical load carrying members shall be lowered 40 °F.

**906.05 Foundation Piles.** The manufacturer of the steel used in piling shall furnish the Department with a certified report showing the physical properties.

Foundation piles shall meet the following requirements as applicable for the type pile required, except that pile cutoffs in good condition and meeting size and thickness requirements will be accepted without mill test reports. In such cases, the Contractor shall furnish the Engineer with two copies of an affidavit stating that the material furnished meets the specifications.

- A. **Steel H-Piling and Special Sections.** Steel H-piling and special sections shall meet the requirements of AASHTO M 270 Grades 36, 50, or 50W.
- B. **Steel Shells for Cast-in-Place Concrete Piles.** Refer to plans for nominal outside diameter and the minimum thickness of metal in the shells. Cylindrical pipe shells shall meet the requirements for welded and seamless steel pipe piles of ASTM A 252, Grade 2.
- C. **Pile Points.** Pile points shall meet the dimensional requirements shown on the plans. The Contractor shall furnish certification showing that the steel used in the fabrication of the points meets any one of the following specifications: AASHTO M 270 Grades 36, 50, or 50W, SAE Grades 1016 through 1027, or SAE Grade 1030.

**906.06 High-Strength Steel Bolts, Nuts, and Washers for Structural Joints.** Fasteners for structural joints shall be high-strength bolts meeting AASHTO M 164, Type 1 bolts, nuts meeting AASHTO M 291 Class 10S or AASHTO M 292 Grade 2H, and washers meeting AASHTO M 293, Type 1 for circular, beveled, clipped circular, and clipped beveled washers.

All bolts, nuts, and washers shall be hot-dip galvanized according to AASHTO M 232. Galvanized nuts shall be tapped oversize according to AASHTO M 291 and shall meet Supplementary Requirements S1, Lubricant and Rotational Capacity Test for Coated Nuts and S2, Lubricant Dye.

**906.07 Pins and Link Plates for Steel Bridge Construction.** The material used for link plates shall meet AASHTO M 270 Grades 50 or 50W and the material used for pins shall meet ASTM A 276 UNS designation S21800 or S20161 annealed stainless steel with 50 ksi yield point, except as modified herein.

Longitudinal Charpy V-Notch impact values for both pin and link plate materials in redundant structures shall meet the requirements specified for high strength structural steel in Subsection 906.04. The steel yield point stress used to determine the testing temperature shall be the value given in the certified mill test report. In order to meet the Charpy V-Notch impact requirements, the steel may need to be heat treated.

Notch toughness tests on specimens shall be performed according to Frequency (P) Piece Testing of AASHTO T 243.

Longitudinal Charpy V-Notch impact values for both pin and link plate materials in non-redundant structures shall average 30 ft-lb when tested at the Lowest Anticipated Service Temperature (LAST) specified for the MDOT district in which the structure is located.

REGION	LAST
Superior	-25 °F
North	-20 °F
Grand & Bay	-15 °F
Southwest, University, & Metro	-10 °F

**906.08 Shear Developers.** Shear connector studs shall be designed for end-welding to steel beams and girders with automatically timed stud welding equipment. The type, size or diameter, and length of stud shall be as shown on the plans. Shear connector studs shall be selected from the Qualified Products List.

An arc shield (ferrule) of heat-resistant ceramic or other suitable material shall be furnished with each stud. The material shall not be detrimental to the welds or cause excessive slag and shall have sufficient strength so as not to crumble or break due to thermal or structural shock before the weld is completed.

Flux for welding shall be furnished with each stud, either attached to the end of the stud or combined with the arc shield for automatic application in the welding operation.

Shear connector studs shall conform to the requirements for cold-finished carbon steel of AASHTO M 169, cold-drawn bar, Grades 1015 or 1020, either semi- or fully-killed. If flux-retaining caps are used, the steel for the caps shall be cold-rolled, of a low carbon grade suitable for welding, and shall conform to ASTM A 109.

Tensile properties as determined by tests of bar stock after drawing or of finished studs shall conform to the following minimum requirements:

Tensile strength .....	60 ksi
Yield strength .....	50 ksi
Elongation .....	20 percent in 2 inches
Reduction of area .....	50 percent

Tensile properties shall be determined according to the applicable sections of the methods for mechanical testing of steel products in AASHTO T 244. The yield strength shall be determined by the 0.2 percent offset method.

Finished studs shall be of uniform quality and condition, free from injurious laps, fins, seams, cracks, twists, bends, or other injurious defects. Finish shall be as produced by cold drawing, cold rolling, or machining.